FORESTCAST [Ep.24]

Women of Research: Changing the World Through Soil with Deb Page-Dumroese

Hosted by Jonathan Yales, edited by Jonathan Yales, and produced by Jonathan Yales, Sharon Hobrla, Kristie Thompson, Jessica Brewen and Suzanne Flory

Research soil scientist Deb Page-Dumroese's research interests center around maintaining soil productivity during and after land management activities.

As site principal investigator for several North American Long-Term Soil Productivity Study plots, Deb is well-versed in the pre- and post-treatment sampling necessary to determine changes in above- and below-ground nutrient properties associated with harvesting, organic matter removal, and biochar additions. In partnership with the Missoula Technology Development Center (Keith Windell) and Dr. Nate Anderson (RMRS) she developed a biochar spreader to easily distribute biochar on forest sites.

Deb Page-Dumroese, Research Soil Scientist, Rocky Mountain Research Station, Moscow, Idaho

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DEB PAGE-DUMROESE: "When I first started at Grand Valley State [University], it was, you know, when you're young, right, you still have those ideals that, 'I'm gonna change the world,' and, I'm not quite sure I've changed the world, but I think that a lot of the work that I've done has made some small incremental changes in how we view soil as a resource, and bring more recognition to the fact that trees grow in soil, we get all these other benefits from soil—like, water holding, water filtration, nutrient retention—you know, how can you improve that over time and make sure that we still have a resource going forward to grow the things we want: trees, shrubs, grasses, forbes, filter water. And, you know, we never wanna revisit the dust bowl of the early century, right? And so, how can we continue to do the things we need to do, but still protect the soil?"

"I had some awesome science teachers in high school who really made the effort to link the little pieces together into a big picture and talk about our responsibility to manage, or to take care of, or to shepherd along, that ecosystem ethic that everything is connected. And so, I recycle, right? That's part of that 'save the world philosophy' as well, right? If it can reduce my waste, I can help my one little bit to reduce that. So, that everything-is-connected mindset was really the part where it all started to click together. So, you know, it led me to soil because that's where my passion was, but I think I still realized that all of the pieces are connected. You know, maybe that's

the Aldo Leopold philosophy as well—all the parts are connected, don't get rid of one until you figure out where it's connected and what it does in the ecosystem."

"When I was at Grand Valley State University, I was able to do an internship with the agricultural research station there on campus, and at that point, I don't think I really still knew that soils was where it was at, but that started the spark. I think that early reading of Rachel Carson and 'Silent Spring' also prompted me to think about environmental science as a whole. And so, when I started at Grand Valley, it was in environmental science, and my major professor at the time thought that I really wanted to work in, like, chemicals, and cleaning up chemical impacts. That was now my thing at all. And so, I kind of floundered for a little bit until I found the soil staff at Grand Valley State, and took all of the classes, plus some independent study classes. And, that set me up for working on a master's at Michigan Tech University. And, at Michigan Tech, things started to gel. You know, I had to have a research project. And, at that time, again, I was pretty clueless, I didn't really know what I wanted to do, and so, the first summer I went to Michigan Tech, I was able to come out and help work on some past studies that had been going on between Michigan Tech University and, at that time it was the Intermountain Research Station before they merged with Rocky Mountain Research Station. So, worked in a variety of locations in Montana and north Idaho, and had a great time. And, at the end of that summer, the person who had become my major professor came out and gave a presentation about his work that had been going on in New Zealand. And, it was, 'Let's see if we can get something going like that at this experimental forest,' and the Forest Service agreed and we started a project. And so, my research then became coming out for a couple of summers working with the Forest Service and Michigan Tech to get my master's done. And then, towards the end of that, I was really keying in on the forest soils piece, and organic matter, and that linked in with the work that was going on here in Moscow, Idaho, on how much wood do you leave after harvesting, and ectomycorrhiza. And so, they were real interested in continuing that work, and so, I came out for the last time with my masters, and we all went for dinner and I said, 'Ah, you know, I'd really like to come out west for a job. You know, what do you think about this agency or that agency?' And then, at that time, the person who was my supervisor for the Forest Service side, said, 'Well, you know, we have an opportunity if you would go for your PhD at the University of Idaho, you could be'—they were then called co-op students, now they are called Pathway students—'but, that's an opportunity.' And so, I jumped on that, started my PhD at the University of Idaho, and I worked here at the [Rocky Mountain] Research Station while getting my PhD, and then when I was done, I was converted to a research soil scientist."

"So, right after I was moved to a permanent research soil scientist, The North American Long-Term Soil Productivity [Study] started. And, that was [an] experimental design that was used all across the U.S., and it was compaction and organic matter removal and what are those impacts on stand productivity. And, at the time, the reputation of soil scientists on National Forests, and probably in research, were that we were 'soil cops,' and our only goal was to shut down logging operations. So, what this North American Long-Term Soil Productivity Study did

was give us a way to start to validate how much compaction and organic matter removal a site could tolerate at different locations and different climates, and what that would mean to overall productivity. So, that study, it went like wildfire. We started out with a few demo plots on some experimental forests, and then, a lot of research soil scientists around the country started working with National Forests to put in their own plots. And, you know, I think that one piece early in my career, you know, to get started with a group of scientists like that, you know, they were all willing to work with me, teach me, mentor me, and learn from my experiences on my sites about what are those two simple things that you can alter with land management—compaction and organic matter removal—and then do a replicated study all across the U.S.. You know, I think that was probably the most telling piece of my career. And then, that kind of set me up for additional work on what else could we do? How can you develop a standardized protocol that is flexible enough to be used on a wide variety of sites, but that still hones in on specific sites? You know, like, we logged this site in the winter and that was not good, or, we logged this site in the summer and that was not good. And so, you know, being able then to allow soil scientists to move from that 'soil cop' mode to really working with the silviculturists or the foresters or the hydrologists, and be able to start to say, 'Well, you know, we've noticed with our monitoring that we get this kind of impact with this kind of equipment, so maybe the next time we harvest a site we should think about doing it in this season, or with a different piece of equipment that has fewer impacts on the site.' And so, that Long-Term Soil Productivity Study really helped to build that foundation that helped move a lot of the pieces forward. And, I was able to just help them click into place."

"Most of the classes that I had were taught by male professors. And, when I was at Grand Valley State, there were only three or four women in the soils group. So, we kind of, mostly hung out together. But, I have to say there were—I never experienced any, 'You shouldn't be here, you don't belong.' All of my experience from Grand Valley, Michigan Tech, to working with the Forest Service have been, 'Yeah, absolutely, you belong, and you're valued, and your opinions matter.' You know, there have been times when I've gone to conferences with loggers that they often don't really wanna take you seriously until you offer them the opportunity to tell their part of the story. And so, that's kind of how I've navigated those negative responses to me is to just flip it back and ask, 'So tell me about your work and what are you experiencing?,' and then try to sneak in a little bit of soil story to go along with it. And, as part of the work with the monitoring protocol, we developed a picture guide, and so, I found it to be pretty effective to put up some slides at a presentation with a logger group and say, 'One of the things that we're trying to do is avoid impacts that look like this—you know, rutting or compaction—and so, if I tell you ahead of time that I want the site to look like this, with some light impacts on the soil, could you do that?'. And, it was amazing to see the response that would come from the logger group and say, 'Oh, yeah, yeah, yeah, you know, I can do that. Or, I would log it this way so that you would have less impacts.' And so, then I'd say, 'But, you know, sometimes I still get these negative impacts, and why is that? Tell me why.' You know, I don't always get the response that I would be looking for. And they'd say, 'Oh, you know, it's the operator. Sometimes we put young operators and they don't know how to run the equipment, or they don't know the limitations of the equipment.' And

so, I said, ‘How can I get around that then if I want to reduce impacts?’ And so, their response to me was, ‘Well, you need to tell us which sites are more sensitive, and when, and then ask for the experienced operators.’ And so, I've been able—through my contacts with them—to then be able to tell the National Forest System people who do the day-to-day management, these are the responses I hear. And so, we just, kind of, inserted ourselves into some of those conversations. And, I think, the loggers were more willing to do the weird things we asked them to do, like, you know, drive over this piece of ground eight times to compact it to its maximum amount, or scrape all the organic matter off and pile it over here because we want to do these trials. Just having somebody take interest in the work that somebody else is doing, is probably part of the most beneficial piece that I've learned along the way. Just make sure that they realize that their work, it's all part of the reason why we're doing the research that we're doing is because we want to change or improve on or adapt, you know, because some people were pretty innovative in how they do their logging, so, let's adapt that.”

“So, I think it was my supervisor when I first came on with the Forest Service, and there were several scientists here at the Station that also encouraged that, you know, you can't work in a bubble and you need to get your message out. But, going back to the Long-Term Soil Productivity Study, the person that was actually spearheading that effort from the research side, I visited his sites in northern California, and we walked around, and there were several times when he told me that data isn't available unless it's used by land managers. And so, I think it was a whole group of people who were really pushing me to make sure that I was telling that story. Not just to other scientists, you know, that's important too, but also to land managers or foresters or soil scientists or whoever the story might reach to be able to talk about, you know, here are the results from the research, whether it's mine or as a whole for this group, from the Long-Term Soil Productivity Study. And then, how can you take a piece of that and start to implement that on your forest?”

“And so, I think it's—my job is to communicate my science to not only the Forest Service, not just write the paper and leave it at that, but to go to meetings, to go to workshops, to interact at the regional soils meetings as much as I can to help make sure that what I'm finding in research gets told to those people who can help make a change in management. And, probably part of that is if I'm gonna change the world, people have to know about it, right? And, that's carried through my entire career. I worked, since about 2000, with the National Forest System side, and now my career has focused on biochar. How can we reduce slash pile burning? Those impacts on the soil can be huge and can last decades when we burn slash piles. And so, how can we not burn slash piles in the same way we always have, and do something different? And so, that's led to, ‘Hey, can we create biochar out of these slash piles that have no value?”

“So, a couple of us here at the Rocky Mountain Research Station had put in a proposal to look at, could you do inwoods processing of woody biomass and turn that into three products: biochar, bio oil, and a syngas. And so, we held several demos in Oregon with a unit that was not great. And so, that kind of set us back, but we were still interested in reducing the impacts of slash pile

burning, and what do you do with this wood that has no market value, and could you do something different with it? And, it was about that same time that a soil scientist on the Umpqua National Forest called me up and said, 'Hey, what do you know about biochar?' And, could we use it to increase wildlife forage in the uplands to keep wildlife out of the riparian areas longer into the growing season? And so, I said, 'I don't know very much about it, but let's work on it and see what we can figure out.' And so, we've worked together now for 20 years, and we put in some trials with biochar that we were able to get from the only place at that time that produced biochar, was in Canada. So, we trucked it down to southern Oregon and we put out some trials, and since then, we've put out more and more trials. And, at the same time we were also working to see if we could figure out that inwoods processing piece that would increase the scale of turning waste wood into biochar so we didn't have to burn as many slash piles. And, again, working with the soil scientist in Oregon, he had done a lot of work with mechanics and welding and building machinery, and so, he would start with the design, 'Can we do this or that,' and I would say, 'I don't know very much about those kind of things, but, oh, could we do something like this instead, or what's the value of this biochar?' So, then he was at a meeting that the president of Air Burners, Inc. was at, and they started talking about could you modify one of their pieces of equipment to create biochar instead of just ash? And, the answer was, 'I don't know, let's give it a try.' And so, two years ago, the Air Burners came out with their prototype of this equipment called the 'CharBoss.' And, we demoed it in Oregon at two locations, and it worked pretty well, but the production rate was pretty slow. Not a lot going in, not a lot of biochar coming out. And so, we sent that one back to the manufacturer and they took it all apart [to] see what worked, what didn't work, and then they worked on a redesign. And so, last year, I was able to order two of these new CharBosses, and we've been demoing them around the western U.S.—started at the University of Idaho Experimental Forest, and we've done one on the Flathead National Forest, and I just came back from a demo with a Bureau of Land Management near Springfield, Oregon with one of the units."

"And air curtain burners are just, like, big bins that have an air curtain forced over the top. And so, that curtain of air over the top of the bin keeps the smoke and particulates inside the bin. So, often the only thing you see are waves of heat coming from the top, and you don't see the smoke and particulates, they're left inside the burn bin. And so, the air curtain burner that we are using right now, you can put in sticks, branches, trees that are up to 10 feet long, and we've been using [trees] about 10 inches in diameter, but, our work in Oregon, we were right outside the Holiday Farm Fire, and they had a lot of wood that had been salvage logged and 14, 18, 20 inches in diameter—huge pieces—so we just made them shorter—2- to 3-foot-long bolts—and we put those in, and they work just fine to make biochar. So, the inside has a shaker panel, and the charcoal is sloughed off the wood and it falls through a hole in the bottom onto a conveyor belt and into a quench pan where the charcoal is quenched. And then, you can just shovel it out of the quench pan, make a big pile of biochar for use at the end of the day"

JON YALES: "And, what's 'quench,' what's that like?"

DEB: "Oh, it's, it's just a pan full of water."

JON: “Oh, okay. So, what, what are you, what's coming out, or what are you, like, able to take out? What does that look like?”

DEB: “It looks like charcoal from your barbecue. I mean, so I make biochar in my backyard with branches that have fallen off—we've got some Ponderosa pine trees in our yard—and so, I've been making biochar with that. And, I have to say, I have increased my bean production since putting biochar in my soil, so, you know, it's a big bonus. I have beautiful flowers. The one advantage of biochar in your soil, particularly here in the western U.S., is that it holds a lot of water. And so, if you think about the extended drought that we often have here in the West, biochar is a nice way to increase water holding capacity, and keep that water long into the growing season. What we don't really know is how long does that last, you know, does the carbon just keep migrating downward or does it get stabilized with the other organic matter as it breaks down into mineral soil. So, you know, there's still a lot of research questions to answer.”

JON: “What would it be replacing, or what could it replace now? You know, instead of someone coming in and, like, wood chipping all the down stuff and just leaving it there, like, where would this kind of fill in in that sense?”

DEB: “So, there's a couple advantages. One, I know a lot of places do the wood chipping and leaving that on site, but, depending on the climate, that carbon still goes off into the atmosphere. It acts as a mulch for a few years, and then it slowly disappears. Some of that carbon does go into the mineral soil. So, that's one advantage. The other advantage is we're not open-burning slash piles, whether it's logs or just tops of trees and piles of slash, we're reducing the volume of that, so it's less of a wildfire risk, and we don't have a lot of beetles making their home in that slash. And, we're doing it in a way that there are less amounts of smoke and particulates that are emitted. And, we're producing a product that we can put back in the soil, and sequester carbon that way. And, we get a lot of other benefits as well, like, water holding capacity, or nutrient retention, water filtration, you know, charcoal's a great filter, you use it in your fish tank. It's a nice way to filter the water as it's moving onsite. There's been some work in the mountains to try and improve the amounts of charcoal in the soil because we get a lot of rain-on-snow events now instead of just slowly snow melting in the spring. So, can you hold that water on site longer and filter it through the soil as it makes its way to the river rather than having it all go off in one big whoosh as those rain-on-snow events happen? So, that's another benefit that we see happening.

You know, it's been kind of this evolution of how can we change—you know, we know a lot of our forest stands, particularly in the western U.S. are overstocked, so during those thinning operations, we're generating a lot of biomass and we're piling it up, and they'll still be open pile burning, but maybe we can reduce those impacts on local communities. And, you know, could you use it in places where water is running off road sites that have been treated with salts, and can you catch that before it moves into streams? ‘Oh, yeah, yeah, you could do that, you know, put it in those straw swaddles—a biochar core—that'd be a great opportunity, yeah!’ Could it be used for high quality crops like vineyards or apple orchards where they're removing that waste

woody material and turning that into biochar on site and using it on farm land, you know, those kind of things? So, you know, the opportunities with biochar are many. I think, for me, the bottom line has been, 'How can I change the world, right?' And so, this biochar is a great way to do carbon sequestration in the mineral soil and help to mitigate climate change. And so, it's been evolving since I graduated with my masters, right? You know, the logging impacts, the changes in how you monitor soil, the Long-Term Productivity Study, you know, why is organic matter important, to now, we're adding a carbon rich organic matter substance to the soil and we can reduce open burning, which is, smoke and particulates in the air. And, I'm a realist as well, right? We're not gonna do that everywhere, but there are a lot of opportunities, particularly at the wildland urban interface, where we have a lot of fuels that we don't know what to do with and there's no market for them. So, rather than burn those in an open burning situation with a slash pile, here's another way we can do it. And, the air curtain burners that we're using are a nice way to reduce emissions and particulates at the same time. So it's, kind of, a win-win-win as far as I'm concerned."

JON: "And I guess looking forward, with the rest of your career, the rest of your life, where are you, kind of, like going? Like, are you still chasing some sort of massive change or dent, sort of, in the world as we talked about before?"

DEB: "So, in August of 2024, I will have worked for the Forest Service for 40 years, and that's my planned retirement date. And so, my goal right now is to make sure that I'm mentoring the scientists and the technicians that are still working for me, or might become connected with the projects that I have ongoing to start to take those over. And, I know that they might not take it the same direction I would, but to be in a place that I think they're all well-equipped to take over my job. And so, I think that's part of it. But, also, connecting them with National Forest System people that can help them do the things that they're interested in doing with their research, and making sure that they're connected that way. But, I just think that, you know, having them come to meetings or go to meetings on their own or, you know, just hang out at the bar with me and we talk about these kind of things, I think those are ways that we can keep that same mindset that, you know, the science that we do isn't science until somebody uses it. And, I think, you know, most of the people that I've, you know, been mentoring along have already figured that out by now. And then, you know, of course when I finish, I'll still have papers that won't be published, so I'll continue to work on those. But, yeah, you know, I think it's taking what I've learned, and my biases toward where I think the future of soil science is, and then at least telling people about that and then letting them move on from that point with wherever their career might take them."

JON: "Do you plan to continue to, kind of, take that same sort of mindset, and that action and, kind of, what you've gotten really good at over the past 40 years to something else—to some other hobby? Or are you excited to not have to do any of that, and just do something else, and not have to think about how to save the world with soil for, you know, for a couple years, or something like that?"

DEB: “No, I think it's ingrained, right? Yeah, it's part of who I am. And so, continuing to make biochar in my backyard, and put it in my soil and show people, you know, ‘Here's where I have biochar, here's where I don't. My husband and I have given some of our property to the local land trust, and so they're rebuilding some Palouse prairie. And so, helping the land trust build that Palouse prairie back is, probably, going to be a lot more of what we focus on than our eight-hour day jobs, and being gone to do field demos, kind of, thing. So, yeah, I think there's a lot of opportunities to stay active in that, you know, putting pieces of the ecosystem back together, or improving pieces of ecosystem to make sure that they all still function.”

THIS EPISODE WAS PRODUCED AND EDITED BY ME, JON YALES. MY EDITORS AT THE NORTHERN RESEARCH STATION WERE SHARON HOBRLA, KRISTIE THOMPSON AND SUZANNE FLORY. MY EDITOR AT THE ROCKY MOUNTAIN RESEARCH STATION WAS JESSICA BREWEN.

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